Section 1.5: Introduction to Functions, Domain, and Range

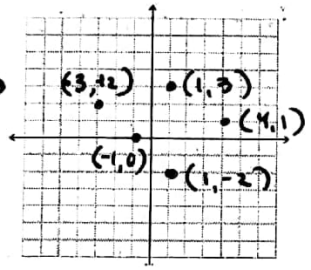
Relation: SET OF ORDERED PAIRS (eg) $\{(1,3),(-2,5),(4,0)\}$
Domain: X-VALUES; INPUT; IND. VAR.
Range: Y-VALUES; OUTPUT, DEP VAR.

A relation can be represented in four ways, they are:
1) SET OF ORDERED PAIRS 2) MAPPING
3) TABLE 4) GRAPH

A **mapping** is a visual representation of a relation in which an arrow associates each input with its output. *input → output*

Example 1: Represent the relation shown below as: **a.** a set of ordered pairs
b. a table
c. a mapping

* TYPO →

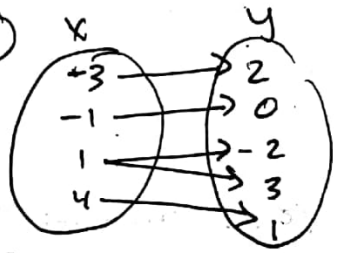


(A) $\{(-3,2),(-1,0),(1,-2),(1,3),(4,1)\}$

(B)

x	y
-3	2
-1	0
1	-2
1	3
4	1

(C)



Determine the domain and range.

$D = \{-3, 1, 4\}$ $R = \{2, 0, -2, 3, 1\}$

The graph above shows discrete data. A graph of **discrete** data consists of individual points that are not connected by a line or curve. Domain and ranges for discrete data are have a finite set. A **finite** set has a fixed countable number of elements.

Graphs where the points are connected shows data that are **continuous**, indicating that domain and range are sets if real numbers with no breaks in between. Domain and ranges for continuous data are infinite sets. An **infinite** set has an unlimited number of elements (*usually expressed as an inequality or number set*).

* A **function** is a relation in which each input is paired with *exactly* one output. *

Function Notes: FOR EACH X-VALUE, THERE IS ONLY ONE Y-VALUE

* ORDERED PAIRS/TBL → X'S CANNOT REPEAT!

Vertical Line Test is a test to see if a graph represents a function. If a vertical line intersects the graph at more than one point, the graph is *not* a function. Otherwise, it is a function.

Example 2: Is the relation above a function? Explain.

NO → X-VALUE "1" IS PAIRED WITH 2 Y-VALUES
→ FAILS VLT (1,3) AND (1,-2)

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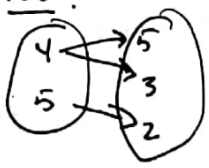
Example 3: Identify whether each list of ordered pairs represents a function. Explain your answers.

a. {(5, 4), (6, 3), (7, 2)} **b.** {(4, 5), (4, 3), (5, 2)} **c.** {(5, 4), (6, 4), (7, 4)}

YES.
X'S DO NOT REPEAT.

NO.



YES
X'S DO NOT REPEAT.

Example 4: Consider a vending machine where inserting 25 cents dispenses one pencil, inserting 50 cents dispenses 2 pencils, and so forth up to and including all 10 pencils in the vending machine.

a. What is the domain (INPUT, $) in this situation? {.25, 0.5, 0.75, 1.25, 1.50, 1.75, 2.25, 2.00}

b. What is the range in this situation? {1, 2, 3, ..., 10}

DISCRETE DATA

c. Does this situation represent a function? Explain.

YES. EACH INPUT HAS EXACTLY 1 OUTPUT.

Example 5: Function rules do not always have to be numerical in nature, they simply have to return a single output for a given input. The table below gives a rule that takes as an input a neighborhood child and gives as an output the month he or she was born in.

Child	Birth Month
Max	January
Evin	April
Zeke	May
Rosie	February
Niko	May

a. Why can we consider this rule a function?

YES. CHILDREN DO NOT REPEAT.

b. What is the output when the input is Rosie?

FEB.

c. Find all inputs that give an output of May. Why does this not violate the definition of a function even though there are two answers?

ZEKE, NIKO.

d. What if the input is the birth month and the output is the child's name? Is it a function?

BIRTH MO. → CHILD.

MAY → ZEKE, NIKO

NO.

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Practice

1. Decide whether each of the following relations is a function. Explain your answer.

Input	Outputs	Function?
(a) States	Capitals	YES, EACH STATE HAS 1 CAPITAL
(b) States	Cities	NO, EACH STATE HAS SEVERAL CITIES.
(c) Families	Pets	DEPENDS.
(d) Families	Last names	DEPENDS.

2. In each of the following examples, use an input-output chart to decide if the following relation is a function.

(a) Consider the following relation: multiply the input by five and then subtract seven to get the output. $5x - 7$

Input x	Calculation	Output y
-3	$5(-3)-7$	-22
0	$5(0)-7$	-7
6	$5(6)-7$	23

Function? (Yes)/No

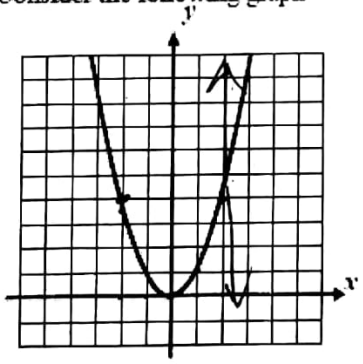
(b) Consider the following table:

Input x	Calculation	Output y
-2	None	4
3	None	3
3	None	2

Function? Yes/(No)

3 → 3
3 → 2

(c) Consider the following graph

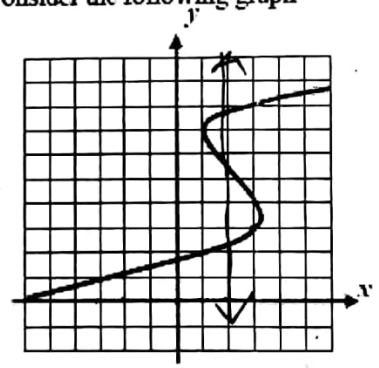


Input x	Calculation	Output(s) y
-2	None	4
1	None	1
2	None	4

Function? (Yes)/No

VLT. ✓

(d) Consider the following graph



Input x	Calculation	Output(s) y
-3	None	1
1	None	2, 7
3	None	3, 4, 8

Function? Yes/(No)

VLT X

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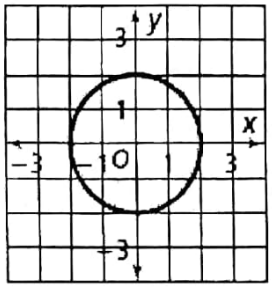
Domain & Range, Functions, & Types of Data

Example 6: For each relation. State the domain, range, and whether it a function. Is the graph continuous or discrete data?

a. $\{(1,5), (2,-3), (-5,4), (1,-1)\}$

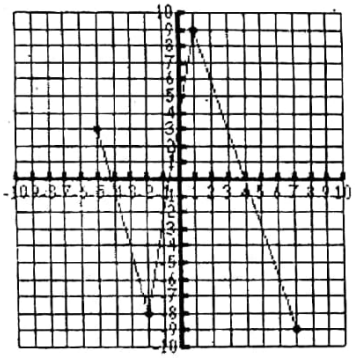
D: $\{1, 2, -5\}$
R: $\{5, -3, 4, -1\}$
F: NO
Discrete or Continuous

b.

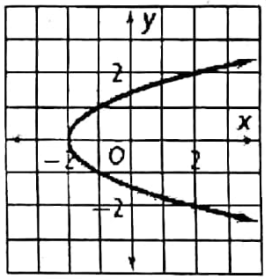


D: $-2 \leq x \leq 2$
R: $-2 \leq y \leq 2$
F: NO. VLT X
Discrete or Continuous

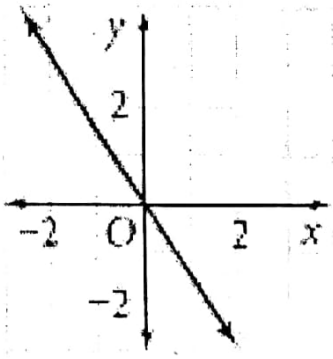
c. D: $-5 \leq x \leq 7$
R: $-8 \leq y \leq 9$
F: YES.
Discrete or Continuous



d. D: $-2 \leq x$ $x \geq -2$
R: IR ALL REAL #'S.
F: NO
Discrete or Continuous



e. D: IR.
R: IR
F: YES
Discrete or Continuous



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